REPORT ON SUPPLEMENTAL LOCATION STUDY IN CHANNEL CHANGE AREA

STICKNEY CREEK TO HARDY CREEK

I 15-4(3)209 & I IG 15-5(5)230

MONTANA HIGHWAY COMMISSION

HELENA, MONTANA

MORRISON-MAIERLE INC.

HELENA, MONTANA

PROJECT 275-08-01.1

INTER-DEPARTMENTAL MEMORANDUM

STATE HIGHWAY COMMISSION OF MONTANA

TO: Fred Quinnell, Jr., State Highway Engineer Date: August 19, 1963

FROM: Grover O. Powers, Interstate Engineer Subject: Interstate Project Stickney Creek to Hardy Creek I 15-4(3)209 & I-IG 15-5(5)230 Routing.

As you know, a supplemental study of alternate locations for the middle portion of the subject project was evidenced as being necessary in view of concerns about the proposed channel change of the Missouri River and the traversing of the more valuable bottom land associated with the location extablished by the Consultant's initial routing study. Therefore, we have not had official Commission adoption of the Stickney Creek-Hardy Creek route and the associated Bureau of Public Roads approval.

The supplemental study has been completed by the Consultant and this is to make distribution of the findings to those concerned with the further necessary action on the matter. The supplemental study does not materially change the location shown to be most favorable in the initial study, but certain detailed location and design changes are established by this study which should alleviate the concerns about the channel change.

Unless official approvals are established on this portion of the project at the earliest possible time, the design program and the Consultant's work will be seriously delayed.

GOP:gh
Enclosure
cc: Commission Members, (one each), (w/cc Morrison-Maierle letter)
Thompson, (w/cc Morrison-Maierle letter)
Briscoe
Chittim, (2)
Hargrove
Bureau of Public Roads 5, (w/cc Letter)
Atten: Adrian Lewis
Morrison-Maierle

Grover O. Powers

Avoid Verbal Instructions

REPORT ON SUPPLEMENTAL LOCATION STUDY IN CHANNEL CHANGE AREA

STICKNEY CREEK TO HARDY CREEK
I 15-4(3)209 & I IG 15-5(5)230

MONTANA HIGHWAY COMMISSION
HELENA, MONTANA

PREPARED BY
MORRISON-MAIERLE INC.
HELENA, MONTANA
PROJECT 275-08-01.1

August 13, 1963

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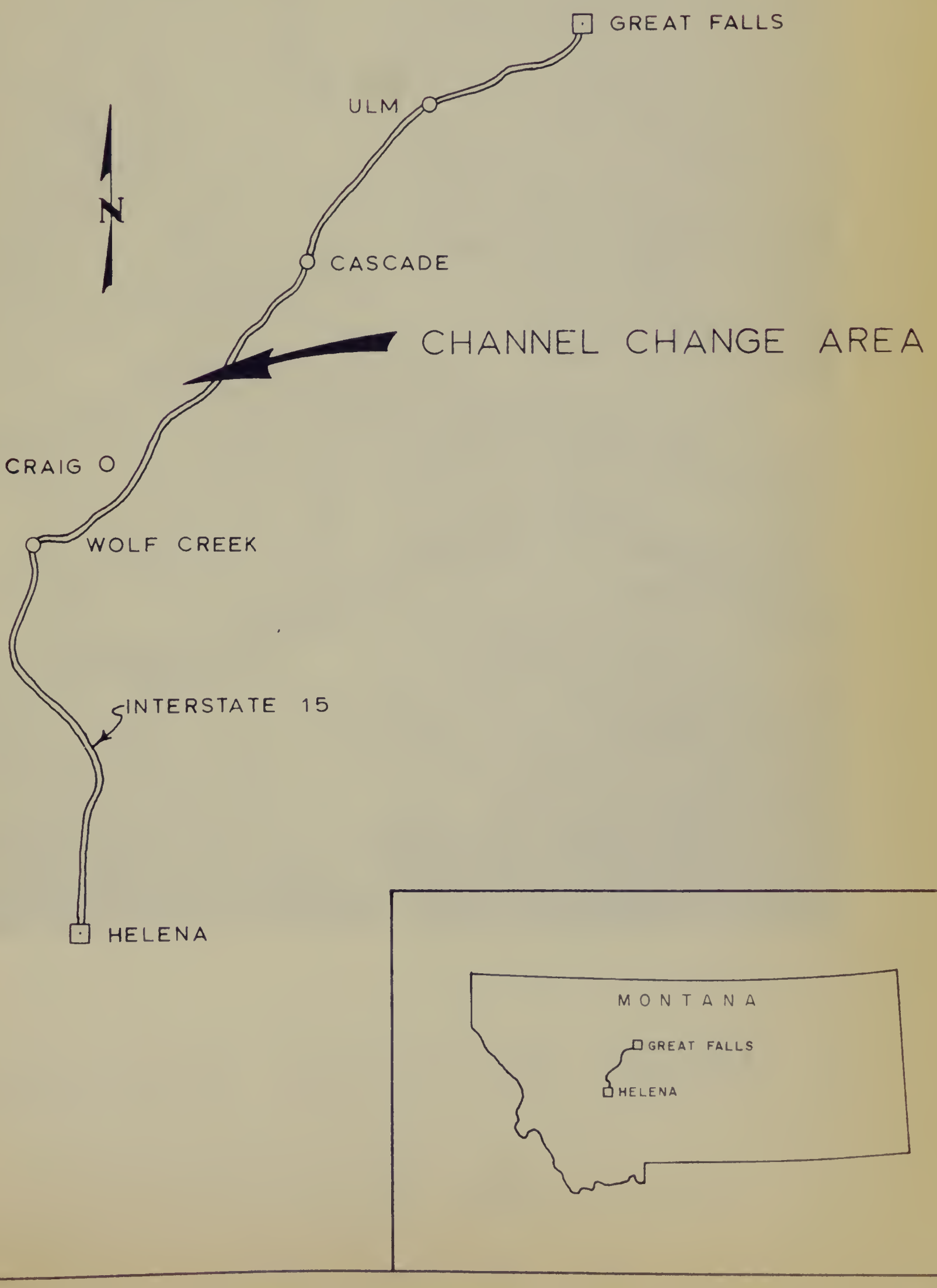
CHANNEL CHANGE AREA

LOCATION MAP



TOPOGRAPHIC LOCATION PLAN

SCALE: 1" = 1400'

SUPPLEMENTAL LOCATION STUDY

The data from additional study of the Interstate alignment in the channel change vicinity are presented in this report. It was prepared at the request of the Montana State Highway Commission. The original study of this area was presented by Morrison-Maierle as "A Report on Location and Design - Interstate Route 15 - Stickney Creek to Hardy Creek" dated January 1963. The aforementioned report should be used with this report as reference for illustration and data which are not duplicated in this report. The new locations studied in this supplemental report have been given the number notations "Alternate 5" and "Alternate 6".

The previous report incorporated, on Alternates 1 & 2, a channel change larger in proportion than anything that has been done on the Missouri River in this area excluding the construction of the power dams. Due to the size of this construction, discussion has been brought forth indicating concern as to whether the proposed location is feasible from the standpoint of permanency and freedom from ice formation and jamming which could possibly induce flooding.

Retention of the alignment that was recommended in the previous report through the channel change area with the elimination of the channel change itself could be made by the construction of two bridges over the Missouri River. This possibility has been considered and estimated costs have been prepared. Since this report compares costs of alternate locations in the channel area, the estimated costs of the bridge construction are included. Alternate 1 with the bridges that replace the channel change is herein termed Alternate 1 (BR).

The specific object of this report is to present the findings and conclusions made from the study of Alternates 5 and 6 and submit the estimated costs in comparison form with Alternate 1 (BR).

FEATURES OF ALTERNATE 5

Alternate 5 would replace any of the numbered alternates in the previous report.

CHANNEL CHANGE VICINITY PLAN
ALTERNATES 5 & 6
SCALE 1" = 1000'

It begins at the point in the previous report entitled "Beginning of Project". From this point which is Station 1056 + 00, to Station 1164 + 40, it is identical in alignment and profile gradient with the previously recommended Alternate 1. At the crest of the hill immediately north of Station 1164 + 40, Alternate 5 continues on a tangent rather than traversing a curve. This places Alternate 5 north of Alternate 1. It continues from this location across a rocky bluff over 200 feet above the river and rejoins Alternate 1 at a point near the Gary Cooper Ranch which is Station 1311 + 45. From this point Alternate 5 coincides with Alternate 1 and remains this way to the end of Alternate 1.

A large scale contour plan of Alternate 5 is shown at the back of this report with the profile. The plan and profile cover only that portion of Alternate 5 that is not identical with Alternate 1.

The rocky bluffs traversed by Alternate 5 were included in the field examination of geology for the previous reconnaissance report. The bluffs consist of massive flows of volcanic breccia and related extrusive rock with numerous dike rock of a highly resistant nature. A determination has been made that the unit cost per excavated yard of this material would be as great as any portion of the Missouri River Canyon. A unit cost of $1.25 was used for each excavated yard. This price is the same as was used in the original report for this type of rock. Sideslopes should stand at $\frac{1}{2}$:1. As a conservative design approach quantities and costs for benching high backslopes have been included in the cost summary. Twenty foot wide benches were placed at one-third the height of the backslope from the roadway on all slopes over 60 feet in height (see typical sections). The extent of benching on Alternate 5 is between Station 1234 + 00 and 1262 + 00. Site drilling and material testing may influence the final extent of benching. The total additional excavation for benches would be 96,182 cubic yards which represents an estimated cost of $120,000.

The deepest cut is 100 feet on centerline. Attention has been given to the possibility of lowering the volume of excavation by a line shift. However, the rock

bluffs are cut by drainage depressions and the fill slopes through these depressions would extend over the railroad. Bin wall to retain the slopes and structures to carry the roadway cannot reduce the excavation costs commensurate with the cost of these items.

The steepest profile gradient is 5 %. This gradient generally follows the ground contour and steeper gradients would not materially reduce the grading costs. There is 600 feet of 4.84% gradient between vertical curves on the westerly side of the crest and 3800 feet of 5% gradient between vertical curves on the easterly side. The profile grade of Alternate 5 has an apical elevation of 3682 feet which is 100 feet higher than any point on adjacent alternates.

The horizontal alignment of alternate 5 has an improvement over the adjacent alternates through a lower total angular deflection. The sharpest curve is 6^{o}. Alternate 5 shortens the total Interstate length by 955 feet (0.18 miles) from Alternate 1, the next shortest alternate.

The portion of Alternate 1 that would be replaced by Alternate 5 contains no interchanges and the service to the easterly side of the Missouri River is provided by the highway that is now in place. Alternate 5 would have the same features. An access road and an underpass would be required at the ranch at Station 1228 + 00 in order to provide service to the opposite side of the Interstate. This road could pass under the Interstate at approximately Station 1223 + 00 where there would be a minimum of cover over the vehicular underpass and a minimum of length required. This pipe is shown in the following summary. The access through the Interstate at the Gary Cooper Ranch would be provided by a lengthened end span in the bridge over the Great Northern Railway.

SUMMARY OF CULVERTS AND ACCESS PIPES ON ALTERNATE 5

Station	Diameter	Description
1181	60"	Drainage
1213	48"	"
1215	30"	"
1223	17'3" x 16' 6"	Access

SUMMARY OF CULVERTS AND ACCESS PIPES ON ALTERNATE 5 - Cont'd

Station	Diameter	Description
1227	108"	Drainage
1239	30"	"
1279	60"	"
1271	36"	"
1283	30"	"
1287	30"	"
1293	Double 108"	"

FEATURES OF ALTERNATE 6

Alternate 6 would replace any of the numbered alternates in the previous report. It begins at the point in this previous report entitled "Beginning of Project". From this point which is Station 1056 + 00, to Station 1164 + 40 it is identical in alignment and profile gradient with the previously recommended Alternate 1. At the crest of the hill immediately north of Station 1164 + 40 Alternate 6 continues along a $0^{o}45'$ curve to the right. This places Alternate 6 a few hundred feet north of Alternate 1. There is a channel change on Alternate 6 as there is on Alternate 1. Alternate 6 continues around this channel change and rejoins Alternate 1 a short distance beyond. From this point Alternate 6 remains identical with Alternate 1 through the remainder of its length.

The large scale contour plan that shows Alternate 5 at the back of this report also shows Alternate 6. There is also a profile. The plan and profile cover only that portion of Alternate 6 that is not identical with Alernate 1.

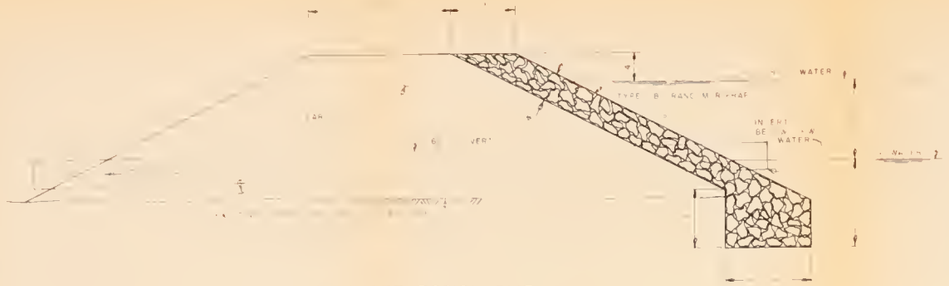
From the contour plan it can readily be seen that Alternate 6 is simply a line shift from Alternate 1. The more extensive study of the channel change area made in this report has produced a more feasible design. More room for the change of the river channel has been obtained resulting in a greatly reduced degree of curvature of the channel change. This should reduce the possibility of ice jamming which could induce flooding. The construction of the channel change will increase the river velocity by means of a shorter channel length. The higher velocity will in all probability prevent icing through this area.

River action is expected to be greater on the Interstate side of the channel change due to the deflection of the river along the curved portion of the new channel length. This and the distance between the change and the existing highway will reduce the necessity for heavy riprap on the side of the channel away from the Interstate. A small point of land that projects into the river 200' upstream from the beginning of the channel change should be removed to provide the most favorable hydraulic entrance for the river. At the end of the change, a 200' length of deflection dike should be constructed to deflect the river into its original channel. These items are shown on the contour plan at the back of this report.

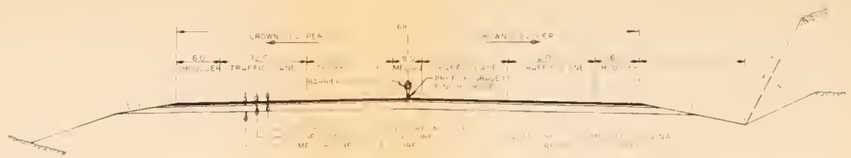
The new channel can be excavated to low water elevation with no major construction problems. Additional excavation in the channel bottom is considered unnecessary. The river will develop itsown low water channel through the 350' bottom. Excavation of a low water channel through the area would not necessarily be permanent since the river would develop its required path in the future.

Three test hole borings have been made in the channel change area. All holes showed that a generally uniform pattern of soil classification lies beneath the surface. The drawing of the cross-section at the center of the channel change shows the soil classification of the nearest bore hole and the layer depths relative to the channel excavation.

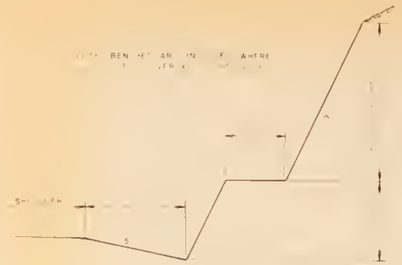
A riprapped dike across the present channel would be required for the deflection of the river into the new channel. A cross-section of this dike and the proposed rip-rap section against it is shown on the following page. The riprap section shown is considered as conservatively adequate for stability against erosion and hydraulic pressures. Actual construction could not conveniently produce vertical limits on the riprap section. Additional riprap yardage is included in the quantities and costs to cover the actual yardage of riprap that will be placed. Riprap rock can be hauled from Station 1170 + 00 or taken from the existing roadway area in the immediate vicinity.



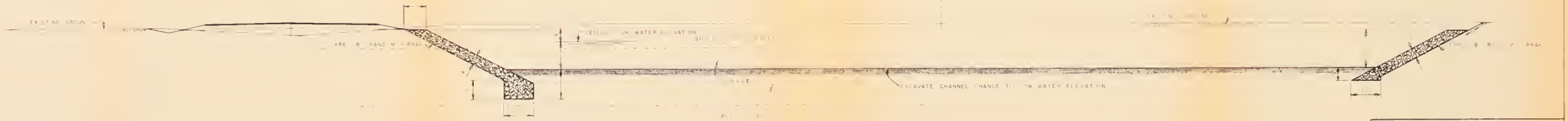
ALTERNATE 6 DEFLECTION DIKE



TYPICAL SECTION



BENCH IN ROCK CUTS



ALTERNATE 6 HANNEL CHANGE CROSS SECTION AT STATION 1241+00 (SECTION A-A)

TYPICAL SECTIONS

The dike as planned is 20 feet wide at the top excluding the riprap. This will be wide enough for transport and dumping and should create no difficulty. Sixty inch C.M.P. culverts placed through the dike and Interstate fills will keep the old river channel alive and furnish stock water. Because there is 6 feet of drop in the water surface between the beginning of the channel change and the end, and there will be three sixty inch pipes in series in the old river channel, the pressure head differential on opposite ends of each pipe should be approximately one third of the total or two feet. The equalization of head should occur during moderate and high flows as the pipes become full or submerged since this water must eventually re-enter the river. This will cause filling of the old channel in both areas. Thus a large differential in pressure head between opposite sides of the embankments of the dike and Interstate will not occur. The dike will only have to serve to a small extent as an earth dam. However, design features of an earth dam will be used for maximum stability.

The maximum tendency to wash through or over the dike would be as high water developed fast in the river. However, it is during this time also that the old channel is filling up. No failure of the dike should occur since the area behind it would fill with water and act as a buffer or dampening reservoir. The main flow of the river would continue to flow in the channel change and the Interstate embankment would be unharmed. Since any large volume of water on the upstream side of the Interstate embankment at Station 1230 + 00 would be largely static, it is considered unnecessary to provide riprap protection there.

Any tendency for the pipes to fill with sediment would be counteracted by self cleaning during high flows. The river does not carry a great amount of debris but precautions against culvert plugging by debris can be over come by the use of trash barriers which have been included in the costs.

Excavation for the channel change should not be difficult. In the cost summary at the back of this report a unit cost of $0.45 per excavated yard was used. This is $0.05 higher than costs for similar excavation in other places as equivalent compensation

for hauling the material to other areas. The quantity to be removed for the channel change is much larger than the new Interstate embankment required between Station 1230 and Station 1255. No rock other than that shown in the previous report in Alternate 1 should be encountered.

The profile gradients will be almost the same as Alternate 1. On Alternate 1 there was 1400 feet of 5% gradient between vertical curves and 1100 feet of 4.2% gradient between vertical curves. Alternate 6 will have these same grades. All other grades are less than 3% and over 75% of the total length of Alternate 6 is less than 1%.

The horizontal alignment of Alternate 6 has a slightly higher total deflection of 723 degrees as compared to 683 degrees on Alternate 1. Alternate 6 is 250 feet longer than Alternate 1.

Access through the Interstate to the ranch at Station 1225 + 00 will be provided by a lengthened end span on the bridge over the Great Northern Railroad. Access to the Gary Cooper Ranch will be through a structural plate vehicular underpass. A culvert summary for Alternate 6 is not shown since it would be almost identical to the summary shown in the previous report for Alternate 1.

FEATURES OF ALTERNATE 1 (BR)

In the previous report Alternate 1, the recommended alignment, was shown incorporating a channel change of the Missouri River as a part of the construction plan. This alignment, but with bridges to span the river instead of a channel change, is termed Alternate 1 (BR). Alternate 1 (BR) though more expensive than Alternate 1 as previously reported, is still more economical than the other adjacent alternates in the previous report. For this reason Alternate 1 (BR) is herein compared with Alternates 5 and 6.

Alternate 1 (BR) would allow access into the cultivated area that would be segregated by Alternate 6 by means of access under the Missouri River bridge. The additional cost to the bridge for this access is included in the cost summary. Also included in the summary is the cost for bridge piles to be placed under both bridges in this area. The three test holes in the proposed channel change have been drilled to

CHANNEL CHANGE VICINITY PLAN
ALTERNATE I (BR)
SCALE 1" = 1000'

approximately 50 feet and no indication of rock depth was evident.

Because Alternate 1 (BR) has the same vertical and horizontal alignment, the advantages and disadvantages of Alternate 1 will be imputed to Alternate 1 (BR). The outstanding disadvantage of Alternate 1 (BR) is its higher costs. The main advantage is the preservation of more cultivated land in this area. The total length of Alternate 1 (BR) is 6.68 miles.

COST DATA

Cost data compiled for the original report for Alternate 1 were used where applicable. Unit costs and swell factors are the same as those in the previous report for all computations. Rock excavation is estimated at $1.25 per yard and common earth excavation is estimated at $0.40 per yard. Additional cross-sections and profiles were prepared and construction costs were computed on the same basis as the original report.

The $3.35 per yard cost for the riprap was considered to be large enough for normal small excavation. However, in keying the toe of the riprap slopes for the channel change, there will be excavation expected to be below the surface of the water where there will be a drag line operation necessary. The cost of this excavation is estimated to be $2.00 per yard and will be reflected in the cost of the riprap when bid by the contractor. In order to find a true evaluation of this item, the special riprap excavation has been computed separately and is included in the "Earthwork" item of the cost summary on the following pages. The material removed by the riprap excavation can be used in the embankment.

In the cost summarys in this report all costs in connection with the channel change such as excavation, riprap, riprap excavation, dike embankments and channel alterations are all included under the item "Earthwork" or "Grading".

No contingencies or engineering costs have been added to the costs in the summary since this item would be added to all alternates and would not affect their relationship to each other when a comparison is being made.

It is recognized by the engineers of the Highway Department that the cost of maintenance on high backslopes in deep excavations is usually higher than other areas. For this reason the Annual Maintenance Cost shown for Alternate 5 in the back of this report has been increased by $1000. per mile through the 2.79 miles where deeper excavations are located. This raises the annual cost on Alternate 5 $2,790. The maintenance costs for all other Interstate mileage is based on $3,000. per mile per year. This is the estimated average for total lengths of all alternates studied in the previous report. The basis for the Annual Cost Comparison is the same as used in the Economic Analysis of the original report. This includes the use of 6% interest on construction costs, the same life expectancy for the various major items, and the same unit vehicle operating costs for comparable grades. The traffic volumes on Alternates 5, 6 and 1 (BR) are the same as for Alternate 1. A summary follows comparing the itemized costs of the Alternates.

MAJOR STRUCTURE SUMMARY
Station 1164 + 40 to Station 1321 + 00

	Structure No. and Station	Structure Description	Estimated Cost
Alternate 1 (BR)	P 400 1225 + 00	Interstate Over Missouri River and R. R.	$763,000.00
	P 410 1257 + 00	Interstate Over Missouri River	$550,000.00
Alternate 5	P 500 1298 + 00	Interstate Over R. R.	$245,000.00
Alternate 6	P 600 1226 + 00	Interstate Over R. R.	$211,000.00

Structures on the above alternates that are outside of the above station limits are shown in the previous reconnaissance report on Alternate 1.

CONSTRUCTION COST COMPARISON

Station 1164 + 40 to Station 1321 + 00

ITEM	Alternate 1 (BR)	Alternate 5	Alternate 6
Length	2.97 miles	2.79 miles	3.01 miles
Clearing & Grubbing	$ 5,000.	$ 15,000.	$ 5,000.
Earthwork	339,708.	1,312,267.	825,744.
Surfacing	264,198.	245,593.	285,605.
Small Drainage Structures	25,250.	176,831.	36,218.
Fencing & Signing	14,458.	14,256.	15,428.
Guard Rail	89,445.	107,605.	95,810.
Major Structures	1,313,000.	245,000.	211,000.
Maintenance of Traffic	-	-	-
Right of Way	24,370.	34,324.	35,370.
Total	$2,075,429.	$2,150,876.	$1,510,175.
Total Annual Construction Cost	$143,410.	$148,010.	$106,229.

Station 1056 + 00 to Station 1400 + 20

Length	6.68 miles	6.50 miles	6.72 miles
Clearing & Grubbing	$ 29,530.	$ 39,530.	$ 29,530.
Earthwork	612,740.	1,585,299.	1,098,776.
Surfacing	638,586.	619,981.	659.993.
Small Drainage Structures	79,604.	231,185.	90,572.
Fencing & Signing	38,150.	37,948.	39,120.
Guard Rail	195,060.	213,220.	201,425.
Major Structures	3,293,000.	2,225,000.	2,191.000.
Maintenance of Traffic	23,090.	23,090.	23,090.
Right of Way	76,000.	85,954.	87,000.
Total	$4,985,760.	$5,061,207.	$4,420,506.
Total Annual Construction Cost	$ 344,537.	$ 349,137.	$ 307,356.

ANNUAL COST COMPARISON

Station 1164 + 40 to Station 1321 + 00

Item	Annual Cost		
	Alternate 1 (BR)	Alternate 5	Alternate 6
Right of Way	$ 1,545.	$ 2,176.	$ 2,242.
Grading & Drainage	31,512.	108,126.	65,050.
Major Structures	87,315.	16,293.	14,032.
Surfacing	23,038	21,415.	24,905.
Annual Construction Cost	143,410.	148,010.	106,229.
Annual Maintenance Cost	8,910.	11,160.	9,030.
Annual Operating Cost	353,327.	338,539.	359,084.
Total of All Annual Costs	$505,647.	$497,709.	$474,343.
Annual Savings in Favor of Alternate 6	$ 31,304.	$ 23,366.	-

ANNUAL COST COMPRISON
Total Length of Alternate
Station 1056 + 00 to Station 1400 + 20

Item	Annual Cost		
	Alternate 1 (BR)	Alternate 5	Alternate 6
Right of Way	$ 4,818.	$ 5,449.	$ 5,516.
Grading & Drainage	65,049.	141,664.	98,587.
Major Structures	218,985.	147,963.	145,702.
Surfacing	55,685.	54,061.	57,551.
Annual Construction Cost	344,537.	349,137.	307,356.
Annual Maintenance Cost	21,626.	23,876.	21,746.
Annual Operating Cost	851,326.	836,538.	857,083.
Total of All Annual Costs	$1,217,489.	$1,209,551.	$1,186,185.
Annual Savings in Favor of Alternate 6	$31,304.	$ 23,366.	-

CONCLUSIONS

It can be seen from the cost summarys that Alternate 6 is the most feasible of the three alternates compared in this report. This coincides with and supports the recommendation in the previous report that changing the channel of the Missouri River is the most economical method of locating the Interstate Highway through this area.

This is the result even though the length of line has been increased over the recommended line length in the original report. More conservative provisions have been included for the assurance of stable permanent functioning of the channel change through a more massive deflection dike and more extensive embankment riprap protection.

The advantage in reduced road user costs gained by a shorter length on Alternate 5 is more than countered by the high excavation costs and unfavorable profile gradients. The costs of the two additional Missouri River bridges on Alternate 1 (BR) makes this alternate the most costly of the alternates compared in this report.

From both standpoints of initial construction costs and total annual costs, Alternate 6 is the most economical alternate. The following comparison is made:

	ALTERNATE 1 (BR)	ALTERNATE 5	ALTERNATE 6
Total Annual Cost	$1,217,489.	$1,209,551.	$1,186,185
Difference in Total Annual Cost In Favor of ALTERNATE 6 Per Year	$ 31,304.	$ 23,366.	-
Difference In Total Annual Cost In Favor of ALTERNATE 6 In 20 Years.	$ 626,080.	$ 467,320.	-

It can be noted that both the initial construction costs and the total annual costs on Alternate 6 are higher than the corresponding costs shown for Alternates 1 and 2 in the original report. However, to obtain a true cost comparison of Alternate 6 and Alternates 1 and 2, the channel costs on Alternates 1 and 2 would have to be modified upward for the more extensive channel change provisions included in Alternate 6. This has not been worked out in detail since it is apparent that costs of Alternates 1 and 2 would increase about the same amount and remain in the same relative order of economic preference.

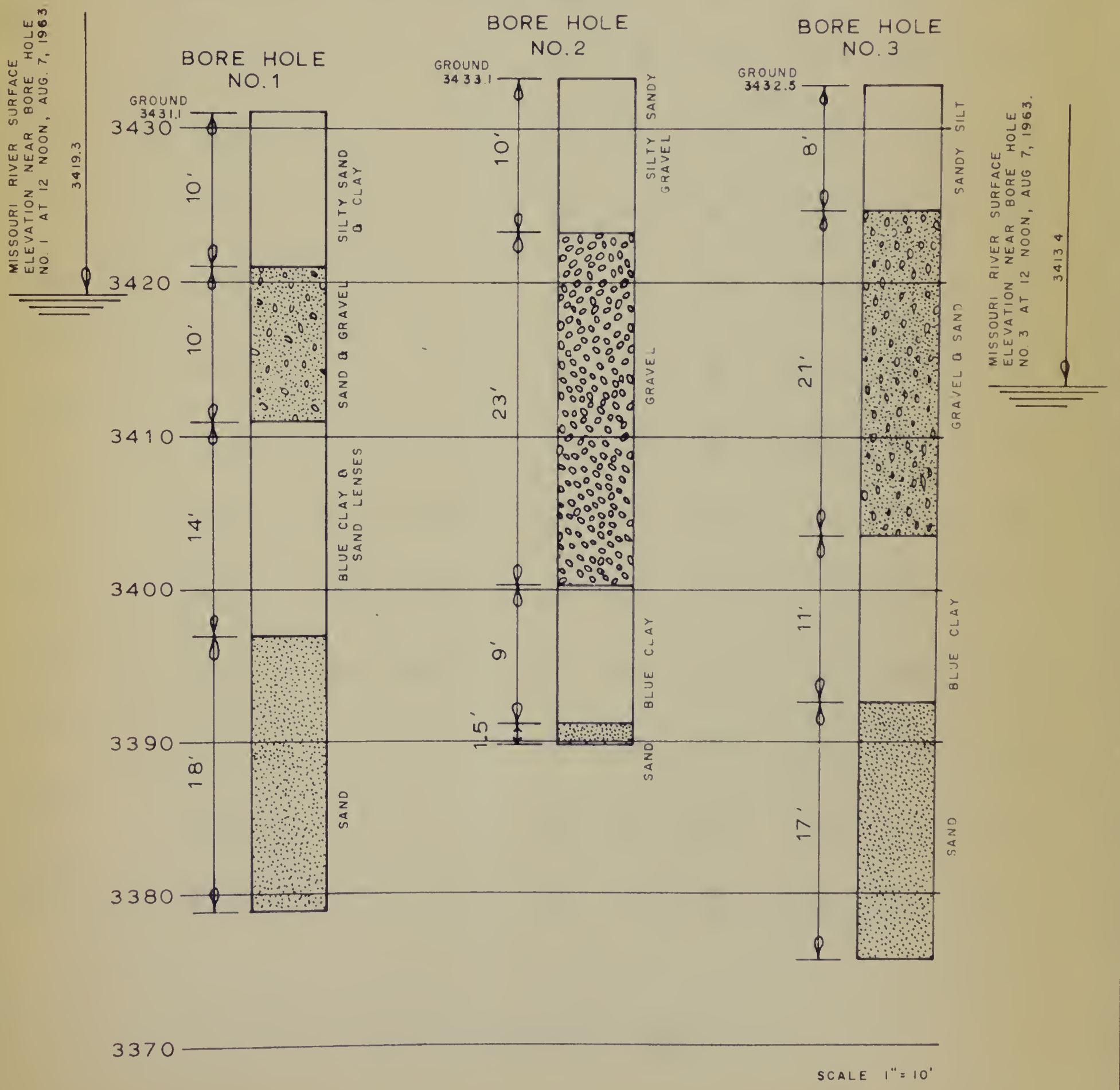
RECOMMENDATIONS

It is recommended that the line location designated Alternate 6 in this report be accepted and approved as the most economical and best location for the Interstate Highway between Station 1056 + 00 near Stickney Creek and Station 1400 + 20, 6.72 miles to the northeast at Interchange 2.

Combining this alternate with the previously recommended location of Alternate C between Interchange 2 and the constructed Interstate near Hardy Creek results in a total length designated Alignment 6-C.

FOUNDATION BORE HOLE LOGS

PROPOSED CHANNEL CHANGE AREA



SCALE 1" = 10'

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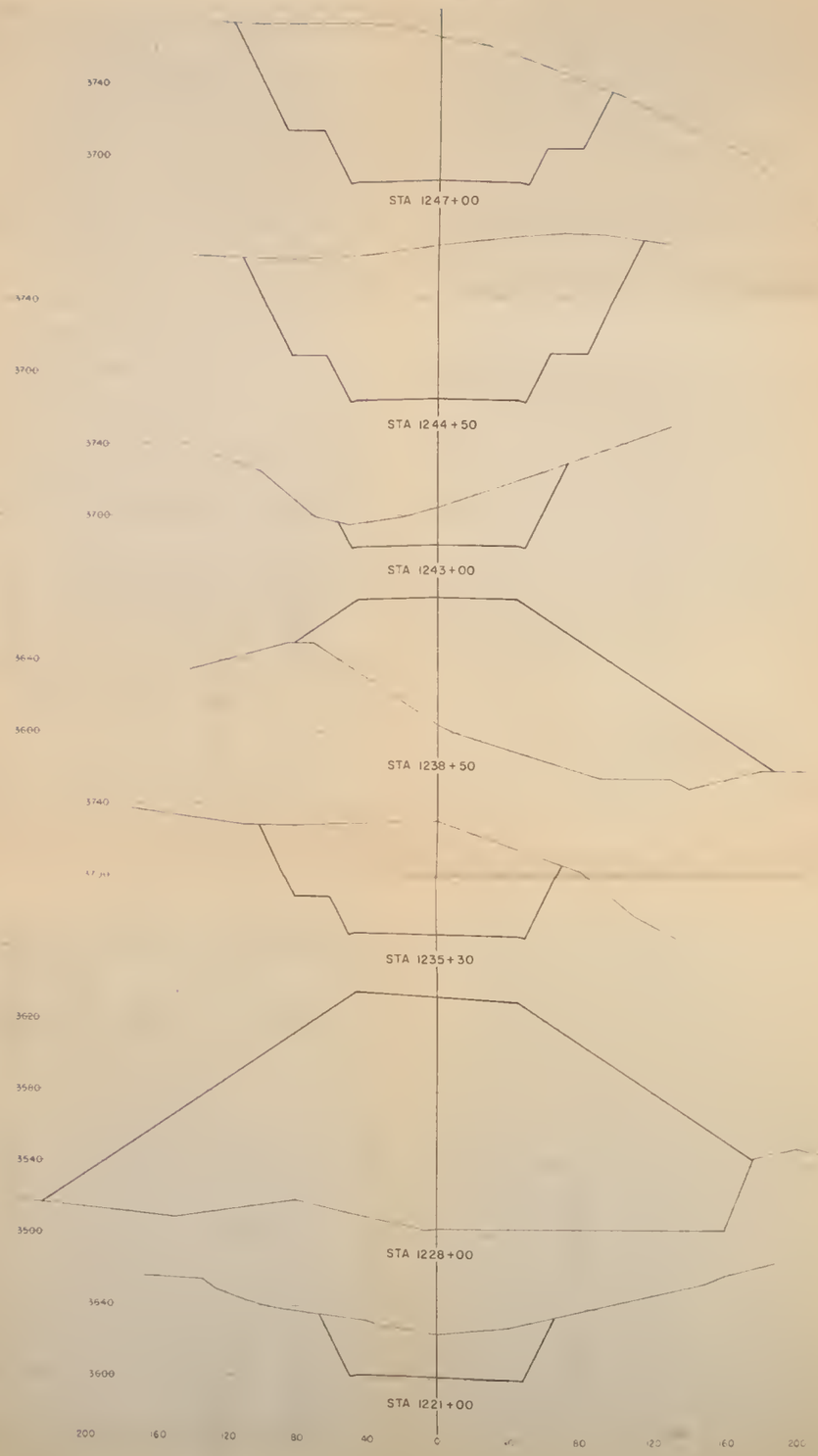


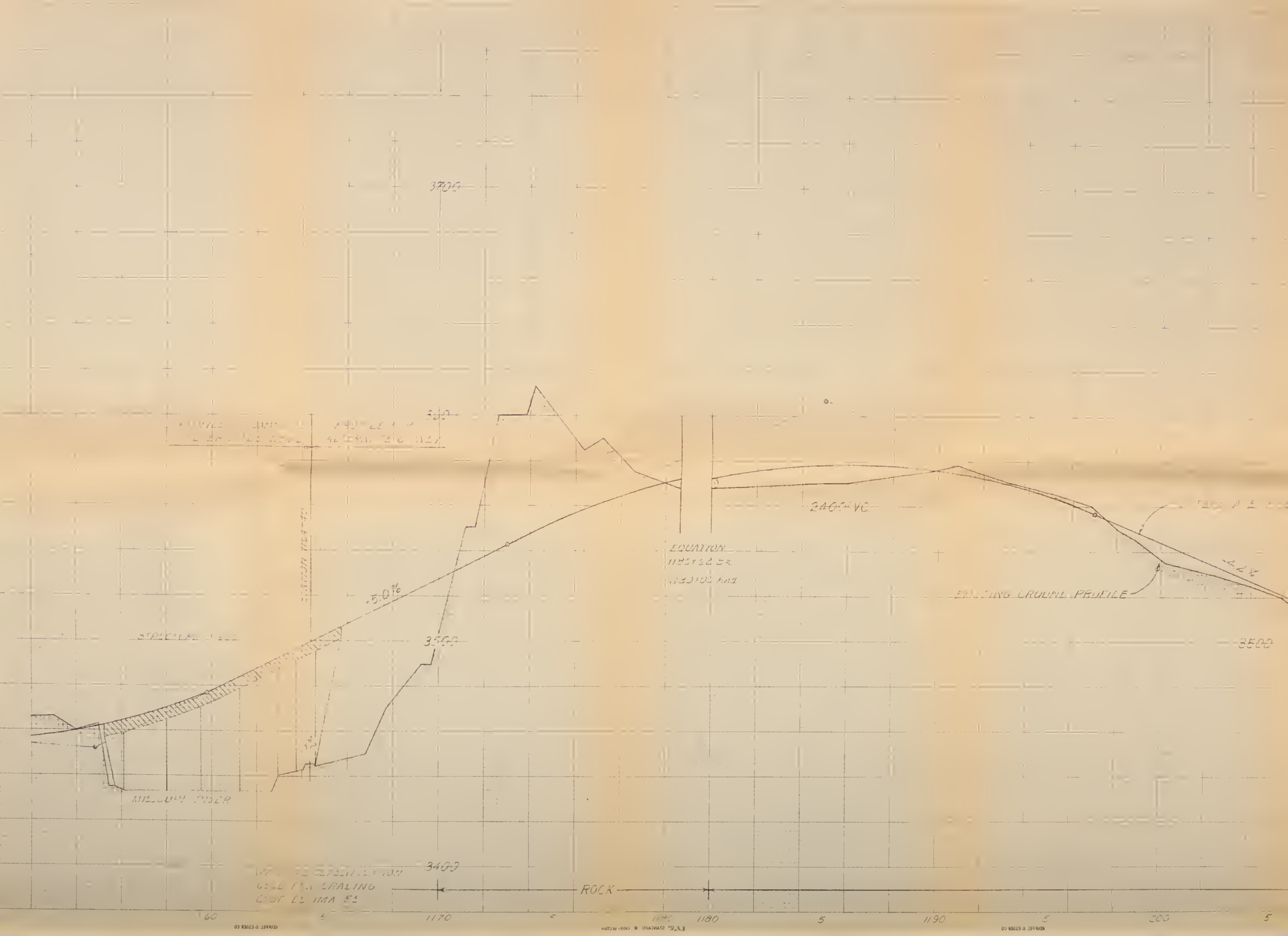
CROSS - SECTIONS
ALTERNATE 5

SCALE 1" = 40'

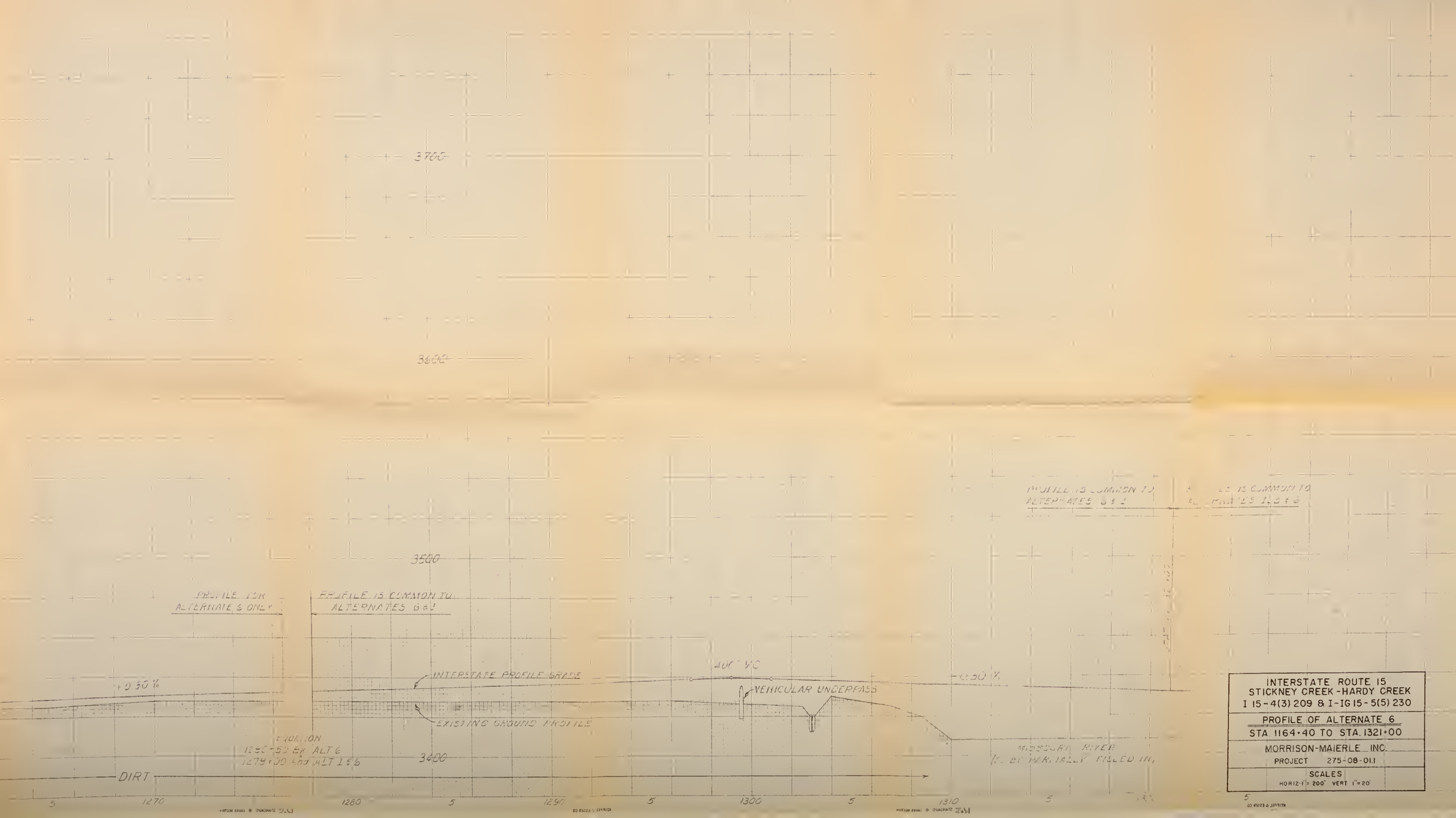
CHANNEL CHANGE AREA -SOILS TEST SUMMARY

BORE HOLE #3

Depth Feet	Natural Water Content %	Dry Density #/Ft ^{3}	Atterberg Limits			Grain Size % Passing Sieve		
			PL	LL	PI	10	40	200
0-3"			NP	NP	NP	82.8	69.0	45.4
5' 6"-6' 6"	9.6		NP	NP	NP	100	91.0	19.2
10' 6"-11' 6"	1.7		NP	NP	NP	34.7	22.4	17.3
15' 6"-16' 6"	2.3		NP	NP	NP	36.0	21.8	3.1
20' 6"-22'	14.4		NP	NP	NP	52.1	28.9	4.4
25' 6"-27'	8.5		NP	NP	NP	29.4	15.1	5.9
30' 6"-32'	28.6	83.5 lbs/Ft^3	22	64	42	100	100	100
35' 6"-37'	36.9	79.5 lbs/Ft^3	26	55	29	100	93.7	90.7
40' 6"-42'	33.3	89.2 lbs/Ft^3	21	40	19	100	98.9	64.1
45' 6"-47'			NP	NP	NP	100	100	10
50' 6"-52'	27.0		NP	NP	NP	100	100	11.7
55' 6"-57'	25.8		NP	NP	NP	100	99.4	10.7

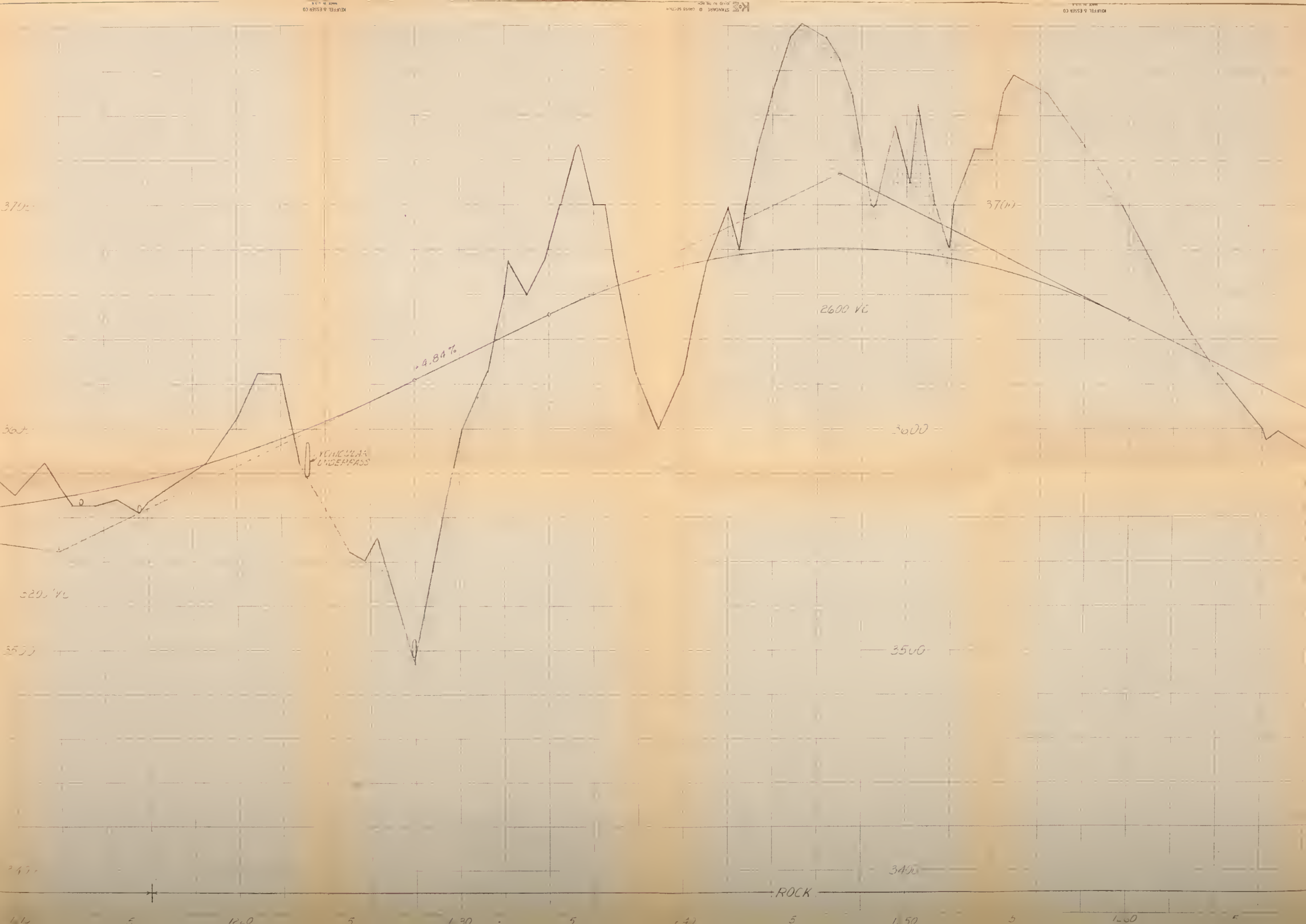

3700
3600
3500
3400
-5.0%
EQUATION
EXISTING GROUND PROFILE
ROCK
1170
1180
1190
200

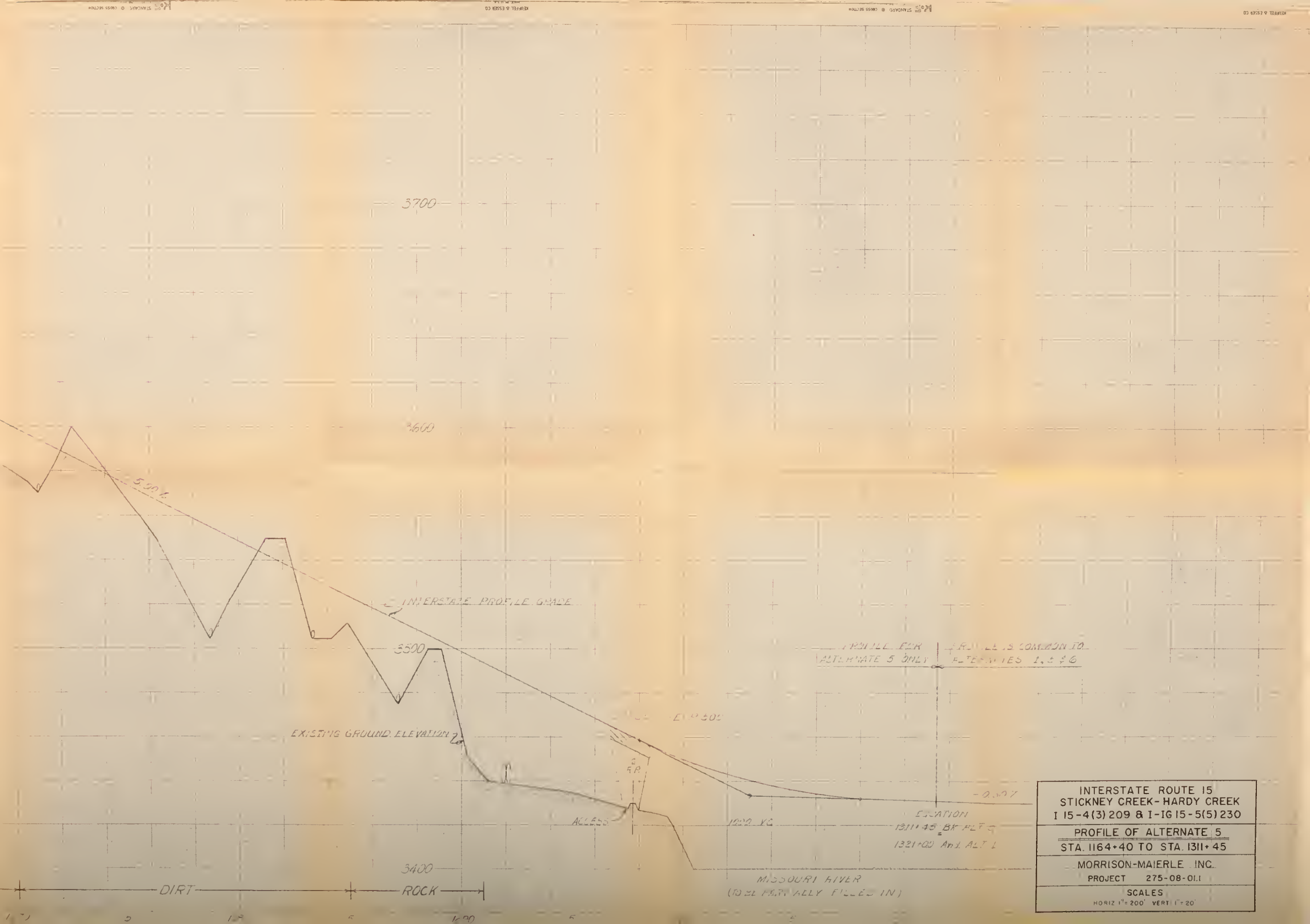

3600
3500
3400
1.0 30 %
ACCESS
MISSOURI RIVER
(EXISTING CHANNEL
TO BE FILLED ACROSS)
MISSOURI RIVER
(EXISTING CHANNEL
TO BE FILLED ACROSS)
DIRT
DIRT
ALTERNATE 5 ONLY
1220
1230
1240
1250
1260
1270



INTERSTATE ROUTE 15 STICKNEY CREEK - HARDY CREEK I 15-4(3) 209 & I-IG 15-5(5) 230
PROFILE OF ALTERNATE 6 STA 1164+40 TO STA 1321+00
MORRISON-MAIERLE INC. PROJECT 275-08-011
SCALES HORIZ-1"= 200' VERT 1"=20'


3700
3600
3500
3400
PROFILE IS COMMON TO ALTERNATES 1, 5 & 6
PROFILE FOR ALTERNATE 5 ONLY
+2.71%
STRUCTURE P.C.O.
MISSOURI RIVER
INTERSTATE PROFILE GRADE
EXISTING GROUND PROFILE
MATERIAL CLASSIFICATION USED FOR GRADING COST ESTIMATES
ROCK
DIRT
119
5
100
5


3700
3600
3500
3400
2600 VC
+4.84%
VEHICULAR UNDERPASS
ROCK



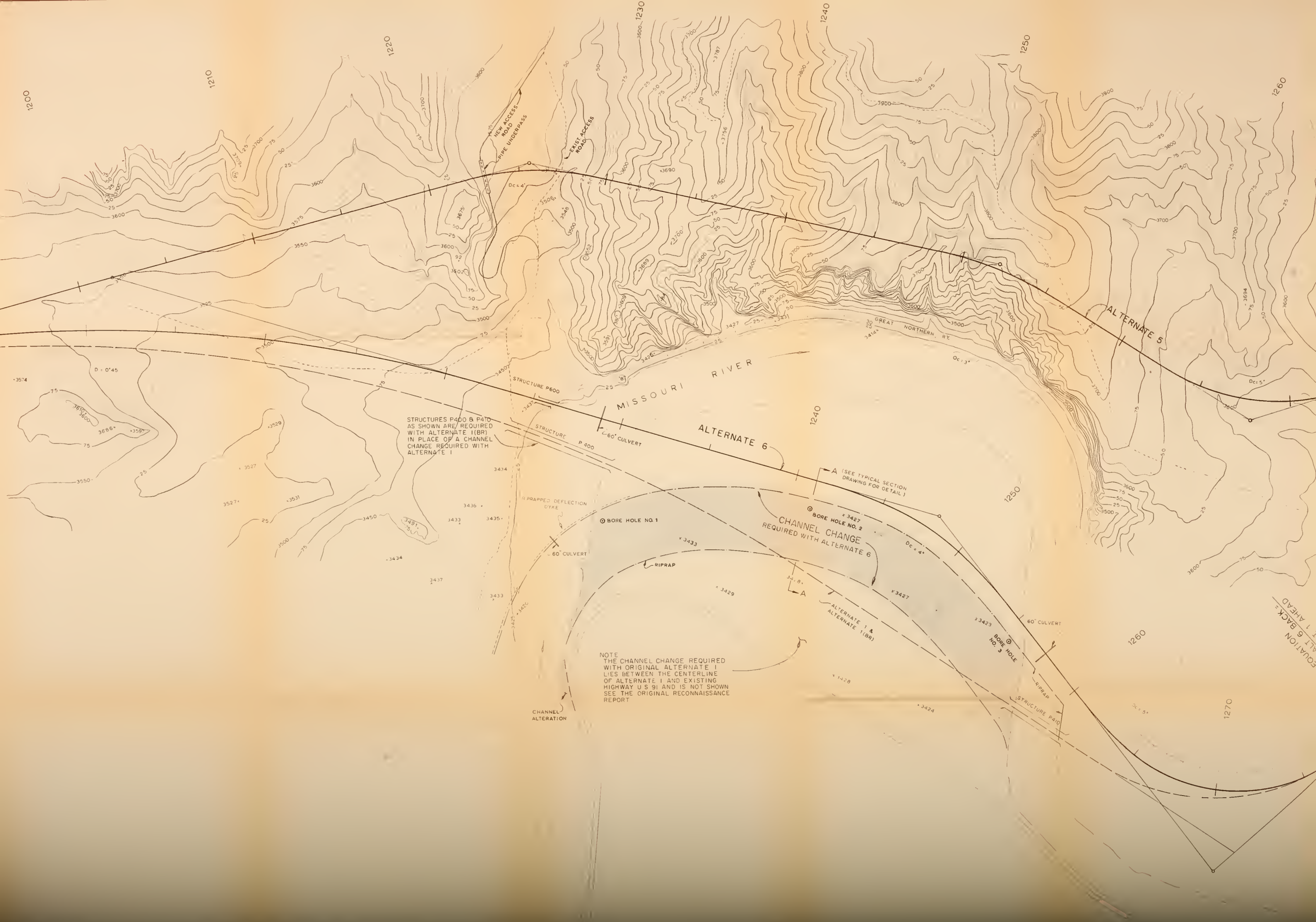
INTERSTATE ROUTE 15
STICKNEY CREEK - HARDY CREEK
I 15-4(3)209 & I-IG 15-5(5)230

PROFILE OF ALTERNATE 5
STA. 1164+40 TO STA. 1311+45

MORRISON-MAIERLE INC.
PROJECT 275-08-01.1

SCALES
HORIZ 1"=200' VERT 1"=20'


1210
1200
1190
1180
1170
1160
ALTERNATE 1
D = 0°45
GREAT NORTHERN RY
MISSOURI RIVER
DEARBORN RIVER
STRUCTURE P 220
TO HELENA
MARSHALL TRACTS
EQUATION
1180+62 ALT 1 & 6 BACK =
1180+00 ALT 1 & 6 AHEAD
EQUATION
1164+40 ALT 1 BACK =
1164+40 ALT 5 AHEAD
1164+40 ALT 6 AHEAD
1164+40 ALT 1 AHEAD


1200
1210
1220
1230
1240
1250
1260
1270
NEW ACCESS ROAD
PIPE UNDERPASS
EXIST ACCESS ROAD
ALTERNATE 5
GREAT NORTHERN RY.
MISSOURI RIVER
STRUCTURE P600
STRUCTURES P400 & P410 AS SHOWN ARE REQUIRED WITH ALTERNATE 1(BR) IN PLACE OF A CHANNEL CHANGE REQUIRED WITH ALTERNATE 1
STRUCTURE P 400
60" CULVERT
ALTERNATE 6
A (SEE TYPICAL SECTION DRAWING FOR DETAIL)
RIPRAPPED DEFLECTION DYKE
BORE HOLE NO. 1
BORE HOLE NO. 2
CHANNEL CHANGE REQUIRED WITH ALTERNATE 6
RIPRAP
ALTERNATE 1 & ALTERNATE 1(BR)
BORE HOLE NO. 3
STRUCTURE P410
CHANNEL ALTERATION
NOTE
THE CHANNEL CHANGE REQUIRED WITH ORIGINAL ALTERNATE 1 LIES BETWEEN THE CENTERLINE OF ALTERNATE 1 AND EXISTING HIGHWAY U S 91 AND IS NOT SHOWN SEE THE ORIGINAL RECONNAISSANCE REPORT
STATION ALT 6 BACK = ALT 1 AHEAD

N

1260 1270 1280 1290 1300 1310 1330

ALTERNATE 5

EQUATION
1311+45 ALT 5 BACK =
1321+00 ALT 1 AHEAD

EQUATION
1280+50 ALT 6 BACK =
1278+00 ALT 1 AHEAD

STRUCTURE P 500

GARY COOPER
RANCH

GREAT NORTHERN RY

ALTERNATE 1

PIPE UNDERPASS

MISSOURI RIVER

TO GREAT FALLS

Dc=5°

Dc=2°

Dc=6°

INTERSTATE ROUTE 15
STICKNEY CREEK - HARDY CREEK
I 15-4(3)209 & I-IG 15-5(5)230
PLAN LOCATION
ALTERNATES 5 & 6
STA. 1164+40 TO STA 1311+45
MORRISON-MAIERLE INC
PROJECT 275-08 011